

Appl. Serial No. 09/802,067
Amdt. Dated October 14, 2003
Response to Office Action mailed July 9, 2003

AMENDMENTS TO THE SPECIFICATION:

Please replace the Title of the Invention, appearing at page 1, line 2 of the specification, with the following amended title:

An apparatus A system for radiating a reference laser beam and utilizing GPS units for installing a pipe an article.

Please replace the paragraph beginning at page 2, line 2 with the following amended paragraph:

In the pit 2, the center of rotation of a guide laser beam radiator 6 is set on a reference ~~point 7~~ point 7A. The center of rotation is coincident with the origin of the laser beam. A theodolite 8 is installed on a support 9 just above the center of rotation of the guide laser beam radiator 6. A pole 11 based on the measurement is set up on ~~the extension~~ an extension line 10 of the line connecting the manhole reference ~~point 7~~ point 7A of the pit 2 and the manhole reference point 7B of the pit 3.

Please replace the paragraph beginning at page 2, line 13 with the following amended paragraph:

As the next step, the worker installs the target 12 at the reference ~~point 7~~ point 7B of the pit 3 in such a manner that the center of the target 12 coincides with the sight line of the telescope 8a. The target 12 has a diffusion plate 12a. The worker can observe the guide laser beam radiated on the target 12 from the guide laser beam radiator 6 side.

Please replace the paragraph beginning at page 10, line 15 with the following amended paragraph:

As shown in Figs. 1, 3, and 8, the The motor drive units 53, 54 and the motor drive unit 34 are all controlled by a control unit 33. The control unit 33 is supplied with the detection signal from the tilt sensor 55. The control unit 45 is connected to an operation panel 56 for turning on and off the guide laser beam radiator 20 and setting the gradient of the guide laser beam, a display unit 57 for displaying the gradient setting, and the photoelectric conversion element 30.

Please replace the paragraph beginning at page 11, line 12 with the following amended paragraph:

Now, the work for setting the direction in which the guide laser beam P is radiated by use of the guide laser beam radiator 20 according to a first embodiment will be explained with reference to ~~Fig. 9~~ Figs. 8 and 9.

Please replace the paragraph beginning at page 11, line 26 with the following amended paragraph:

The center of the first GPS unit 75 is located just above the laser beam Lv in such a manner that the center of rotation of the guide laser beam radiator 20 is located vertically upward of the reference point 77. The first GPS unit 75 is connected to ~~the~~ a radio communication unit 79.

Please replace the paragraph beginning at page 12, line 3 with the following amended paragraph:

A pole 81 integrated with the second GPS unit 76 is used for conducting the work for setting the direction in which the guide laser beam is radiated. ~~The A~~ radio communication unit 82 is integrally mounted on the pole 81. ~~The A~~ second GPS unit 76 is connected to the radio communication unit 82.

Please replace the paragraph beginning at page 12, line 7 with the following amended paragraph:

The first GPS unit 75 detects the reference position (X0, Y0) in horizontal direction on the GPS of the guide laser beam radiator 20. The second GPS ~~unit 80~~ unit 76 detects an arbitrary horizontal position. The reference horizontal direction position data (X0, Y0) of the first GPS unit 75 is transmitted to the radio communication unit 79. The radio communication unit 79 transmits the reference horizontal direction position data to the radio ~~communication unit~~ receiver 20A (see Fig. 8).

Please replace the paragraph beginning at page 12, line 13 with the following amended paragraph:

The worker sets up the pole 81 at the known point 83 as the first position. The known point 83 is determined in advance by measurement according to the working drawing. The pole 81 is erected at the known point 83, and the first horizontal direction position data (X1, Y1) on the GPS is detected. The first horizontal direction position data (X1, Y1) is transmitted to the radio communication unit 82. The radio communication unit 82 transmits the first horizontal direction position data (X1, Y1) to the radio receiver 20A. The radio receiver 20A outputs the reference horizontal direction position data and the first horizontal direction position data to the arithmetic means 20B (see Fig. 8).

Please replace the paragraph beginning at page 12, line 22 with the following amended paragraph:

The arithmetic means 20B, as shown in Fig. 9, calculates the direction Z1 in which the guide layer laser beam P is to be radiated from the reference horizontal direction position (X0, Y0) as an origin, based on the first horizontal direction position data (X1, Y1) and the reference horizontal direction position data (X0, Y0) from the second GPS unit 76 of the pole 81 erected at the first position.

Please replace the paragraph beginning at page 12, line 27 with the following amended paragraph:

Then, the worker sets up the pole 81 at the second position 80 in such a manner that the guide laser beam P is radiated on the pole 81 in the groove 74. The second horizontal direction position (X2, Y2) pole 81 is detected using the second GPS unit 76 when the guide laser beam P is successfully radiated on the pole 81. The second GPS ~~unit 80~~ unit 76 transmits the second horizontal direction position data (X2, Y2) to the radio communication unit 82. The radio communication unit 82 transmits the second horizontal direction position data (X2, Y2) to the radio receiver 20A. The radio receiver 20A outputs the second horizontal direction position data (X2, Y2) to the arithmetic means 20B associated with it. The arithmetic means 20B calculates the actual direction of radiation of the guide laser beam P from the reference horizontal direction position (X0, Y0) constituting an origin based on the reference horizontal direction position data (X0, Y0) and the second horizontal direction position data (X2, Y2). The arithmetic means 20B also calculates the angle ϕ that the actual direction Z2 of radiation of the guide laser beam P forms to the direction Z1 in which the guide laser beam P is to be radiated.

Please replace the paragraph beginning at page 14, line 5 with the following amended paragraph:

According to a second embodiment, the target 23 is integrated with the pole 81. Also, the pole 81 includes a data collector 84, which in turn includes a display unit 84a. The pole 81 also includes a radio ~~communication unit~~ receiver 85. The data collector 84 is connected with the second GPS unit 76 and the radio ~~communication unit~~ receiver 85.

Please replace the paragraph beginning at page 14, line 10 with the following amended paragraph:

The data ~~collector 85~~ collector 84 is arranged on a support table 78 as shown in Figs. 10(a), (b). The data ~~collector 85~~ collector 84 is connected to the first GPS unit 75 and the radio ~~transmitter communication unit~~ 79. The data ~~collector 85~~ collector 84 collects the reference horizontal direction position data (X0, Y0) of the first GPS unit 75. The reference horizontal direction position data (X0, Y0) are transmitted through the radio communication unit 79 to the radio receiver 85. The data collector 84 collects the reference horizontal direction position data (X0, Y0) through the radio receiver 85.